Office of the Fire Marshal

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RETAIL DISPLAY AND STORAGE OF SWIMMING POOL CHEMICALS

July 2001

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GUIDELINE

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TABLE OF CONTENTS

SECTION		PAGE
Abstract		2
Scope .		3
1.0	INTRODUCTION	4
2.0	OVERVIEW OF REQUIREMENTS	5
3.0	PROTECTION REQUIREMENTS	6
4.0	MAXIMUM PERMISSIBLE QUANTITY	8

APPENDIX A – SAMPLE PROBLEMS

APPENDIX B – QUESTIONS AND ANSWERS

APPENDIX C – EMERGENCY PLAN

APPENDIX D – REFERENCES

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Abstract

The Ontario Fire Code (OFC), which applies to existing buildings, does not have specific requirements for swimming pool chemical storage. This document was developed to provide guidance to the fire service and retail storeowners to safely store and display oxidizing pool chemicals.

The guideline has an overview of the various types of pool chemicals in use and describes the methodology and criteria to evaluate the maximum permissible display and storage quantities of these materials. It also provides basic storage requirements to ensure fire safety. The guideline also has a sample emergency plan applicable to these occupancies, and answers to basic questions that the fire service may encounter.

Scope

The provision of these guidelines may be applied to both existing and new construction supplementing the requirements of the Ontario Building Code.

Although this guide does not apply where less than 250 kilograms of pool chemicals are stored and displayed, the general requirements set out in the guidelines will be useful as recommended practice that should be followed for these lesser quantities of pool chemicals.

Note: The Building Code Act requires that a building permit is obtained before any material alteration or new construction is undertaken. Compliance with these guidelines does not relieve the owner from obtaining the required permit.

1.0 INTRODUCTION

This guide has been prepared to help retail storeowners and others safely store and display oxidizing **pool chemicals.** Staff training in these requirements and the emergency procedures developed by the owner will be the key to preventing injuries and property loss.

Although this guide does not apply where less than 250 kilograms of **pool chemicals** are stored and displayed, the general requirements set out in this guide will be useful as recommended practices that should be followed for these lesser quantities of **pool chemicals**.

Oxidizing **pool chemicals** are highly reactive materials that, if mishandled, improperly stored or contaminated, may become unstable and dangerous. When combined with combustible or flammable materials (e.g. garbage, sawdust, solvents, oily greasy rags, incompatible chemicals such as oils, brake fluid, anti freeze and other hydrocarbon liquids) or when exposed to excessive heat, a fire or explosion also may result. In the presence of moisture (small quantity of water) they become unstable and can generate heat that can lead to a fire or explosion. However, use of copious amounts of water would render the product less reactive thus making it an effective suppression agent in a fire emergency.

The two categories of oxidizing pool chemicals commonly in use are "organic" and "inorganic". These two categories are non-compatible with each other, thus should not be stored in close proximity.

Defined terms are in **bold** for convenience:

Bulk liquid chlorine refers to aqueous solutions of not more than 12% sodium hypochlorite contained in large storage tanks. Bulk liquid chlorine should not be included in the weight calculations for the purpose of this guide.

Control area means the portion of a building (i.e. floor area) in which the potential fire spread is controlled by use of,

a) A fire separation having at least a one hour fire-resistance rating, or
b) A minimum horizontal distance of 12 meters between the closest edges of the control areas.

Maximum permissible quantity is defined as the kilograms of **pool chemicals** permitted in a control area where the floor area in square metres is multiplied by 25 kilograms per square metre, provided that the maximum floor area value used in this calculation does not exceed 150 m^2. The actual floor area of a **control area** may exceed 150 m^2, however, no credit is given for the excess area when performing this calculation.

Pool chemicals generally refer to oxidizing pool chemicals or swimming pool sanitizers. Non-oxidizing chemicals used to treat pool water (e.g. algaecide, pH balancers) do not belong to this category. Swimming pool sanitizers are calcium hypochlorite (Class 2 or 3, depending on concentration) and trichloro-s-triazinetrione (Class 2), potassium dichloro-s-triazinetrione,

sodium dichloro-s-triazinetrione (both Class 3), and sodium dichloro-s-triazinetrione dihydrate (Class 1). The above classification is in accordance with the NFPA classification for oxidizers. The NFPA has classified oxidizers into four classes as follows:

Class 1 An oxidizer whose primary hazard is that it slightly increases the burning rate but does not cause spontaneous ignition when it comes in contact with combustible materials.

Class 2. An oxidizer that will cause a moderate increase in the burning rate or that causes spontaneous ignition of combustible materials with which it comes in contact.

Class 3. An oxidizer that will cause a severe increase in the burning rate of combustible materials with which it comes in contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat.

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock. In addition, the oxidizer will enhance the burning rate and can cause spontaneous ignition of combustibles.

Retail display means the portion of the building where the general public has access for the purpose of purchasing goods.

Retail storage means the warehouse portion of the building not accessible to the general public and located on the same site or in the same building as the retail display.

2.0 OVERVIEW OF REQUIREMENTS

When should this guide be used?

The Ontario Fire Code (OFC), which applies to existing buildings, currently does not have specific requirements for safe pool chemical storage. Therefore, this guide may be used with Article 2.1.2.2. of the OFC to enforce safe requirements for **retail display** and **retail storage** for quantities of **pool chemicals** between 250 kilograms and the maximum permissible quantity as calculated on page 7.

For this guide, **bulk liquid chlorine** refers to aqueous solutions of not more than 12% sodium hypochlorite contained in large storage tanks. **Bulk liquid chlorine** should not be included in the weight calculations for the purpose of this guide. However, these tanks should be diked to contain 110% of the volume of the storage tank to prevent spills from endangering the environment as a result of a fire.

For new construction, the Ontario Building Code (OBC) shall be used. The OBC requires compliance with good engineering practice such as is described in the publications of the National Fire Protection Association (NFPA) and the National Fire Code (NFC). It is recommended that the owner consult with the Chief Building Official and the Chief Fire Official to determine applicable requirements.

The NFC shall be used for warehouses that are located at a different site or in another building from the retail display portion of a building. This guide is intended for use solely where retail display and retail storage occur in the same building.

3.0 PROTECTION REQUIREMENTS

Where more than 250 kilograms of **pool chemicals** are located in a building, the following protection requirements shall be met for **retail display** and **retail storage** areas:

- The entire building shall be equipped with automatic sprinkler protection that is designed for the storage configuration and commodities used. This sprinkler system shall be monitored using a water flow detector or similar device to notify the fire department in the event of a fire. The protection and storage configurations shall be designed to comply with applicable provisions of NFPA 13 (1999) – "Standard for the Installation of Sprinkler Systems" NFPA 230 (1999) – "Standard for the Fire Protection of Storage" and NFPA 430 (2000) – "Code for the storage of liquid and solid oxidizers". In-rack sprinklers shall be installed in conformance with the above NFPA codes.

- Where **pool chemicals** are located in a dedicated area, it is permitted to protect that area in accordance with NFPA 430, provided all other areas are protected with sprinklers commensurate with the products being stored.

- Where **pool chemicals** are not located in a dedicated area, the entire building shall be protected for the highest hazard stored in the building.

- In extinguishing a fire, large amounts of water should be used. Portable water extinguishers or water hose reel stations shall be provided for manual fire fighting in accordance with the requirements of NFPA 10, "Standard for Portable Fire Extinguishers", and NFPA 14, "Standard for the Installation of Standpipe and Hose Systems". CO_2 and dry chemicals extinguishers containing ammonium compounds (Class A:B:C) should be prohibited in areas where oxidizers that can release chlorine are stored. Also, halon extinguishers should not be used. Any fire fighting activity necessitates wearing the appropriate personal protective equipment and self-contained breathing apparatus.

3.1 GENERAL REQUIREMENTS

Where any quantity of **pool chemicals** is located in a building, the following general requirements shall apply for **retail display** and **retail storage** areas:

- A no smoking policy shall be enforced in display and storage areas. Suitable signs shall be posted to inform occupants of this policy.

- Good housekeeping shall be practised including immediately cleaning up any leakage from packages and properly disposing of spilled materials.

- An "Emergency Plan" shall be developed as outlined in Appendix C.

- Persons involved in the storage or sale of **pool chemicals** shall be trained in the carrying out of the emergency plan and in the safe handling procedures recommended by the manufacturers.

- **Pool chemicals** shall be stored and displayed in rooms that are cool, ventilated and dry.

- **Pool chemicals** shall be kept in containers that meet Transportation of Dangerous Goods Regulations. In order to minimize the fire hazard manufacturers should consider packaging of class 3 and higher hazard oxidisers in containers made from compatible non-combustible material.

- **Pool chemicals** shall not be displayed on wooden floors or platforms. They should be displayed on solid non-combustible shelving.

- Pallets if used shall be of the solid deck type and constructed such that they are not susceptible to being impregnated with the **pool chemicals**.

- Stored **pool chemicals** shall be separated from flammable and combustible liquids, wood and wood products, expanded plastics (such as styrofoam cups), corrosive substances and chemically reactive materials by a horizontal distance of at least 3.7 meters.

- Flammable or combustible liquids shall not be stored directly above or in such a manner that any spill of such liquids will not come into contact with the stored **pool chemicals**.

- A minimum aisle width of 2.1 meters shall be maintained for **pool chemicals**. Storage aisles should be clear of any storage.

- Display of **pool chemicals** accessible to the public shall not exceed 2.1 meters in height above the floor. The display shall not exceed 1.2 meters in depth.

- The display area requires a very high level of fire prevention measures incorporated (housekeeping, segregation of incompatibles etc.).

- **Pool chemicals** shall not be stored greater than 1.8 meters in height above the floor or 1.2 meters on a shelf.

- **Pool chemicals** shall not be displayed or stored within 3 meters of an exit door.

- Liquid **pool chemicals** shall not be displayed above solid **pool chemicals**.

- Solid non-combustible shelving no greater than 0.6m (2 ft) deep with solid vertical barriers of non-combustible construction shall be placed between different types of **pool chemicals** unless a spacing of 1.2 meters is provided. Vertical barriers of solid non-combustible materials should be placed between incompatible material and the oxidizer (this provides the necessary segregation to prevent the **pool chemicals** coming into contact with each other, and with incompatible materials).

- **Pool chemical** containers shall not exceed 45 kilograms in weight.

- **Retail storage** of **pool chemicals** shall occur only in designated areas to ensure that these chemicals are segregated from incompatible materials as noted above and appropriate hazard signs posted to alert employees, public and emergency responders.

- Storage tanks of **bulk liquid chlorine** should be diked to contain 110% of the volume of the tank.

3.2 PRECAUTIONS SET OUT IN MSDS

Pool chemicals should be stored and handled per the precautions set out in their Material Safety Data Sheets (MSDS). For example, an MSDS for calcium hypochlorite states:

- calcium hypochlorite should be maintained dry and should not be transferred in direct sunlight;
- calcium hypochlorite should be dissolved in water, water should not be added to calcium hypochlorite;
- calcium hypochlorite should be stored in original air-tight metallic containers;
- use a clean, dry and dedicated metal scoop or bucket to transfer calcium hypochlorite;
- calcium hypochlorite should not come in contact with other pool chemicals;
- calcium hypochlorite will react violently producing large quantities of heat if it comes in contact with triazinertriones, or chlorinated isocyanurates;
- containers containing calcium hypochlorite should not be dropped or rolled;
- spilled calcium hypochlorite should not be returned to the containers. It should, however, be diluted with copious quantities of water;
- if calcium hypochlorite comes in contact with clothing, the clothing should be removed and soaked in water as it may ignite spontaneously; and
- calcium hypochlorite should be treated as a hazardous material with unpredictable behaviour.
- calcium hypochlorite should not be permitted to come in contact with any flammable or combustible liquids or corrosive liquids.

For other pool chemicals please refer to their MSDS.

3.3 RECOMMENDATIONS & ADITIONAL INFORMATION

- Fire tests have indicated that after the rapid knockdown of the visible fire by sprinkler action, there has been a sudden flare up after several minutes. Thus, as a precaution, fire fighters should have charged hand lines in place before shutting down the sprinklers. Extreme caution should be exercised in overhauling commodity containers, which have been exposed to a fire due to the possibility of re-ignition, and also the liberation of noxious gases.

- The NFPA 491, "Guide to Hazardous Chemical Reactions" 1997 Edition lists many oxidizers and other materials that result in hazardous interactions.

- CANUTEC has an emergency response number (1-613-996-6666) for assistance 24 hours a day 365 days a year.

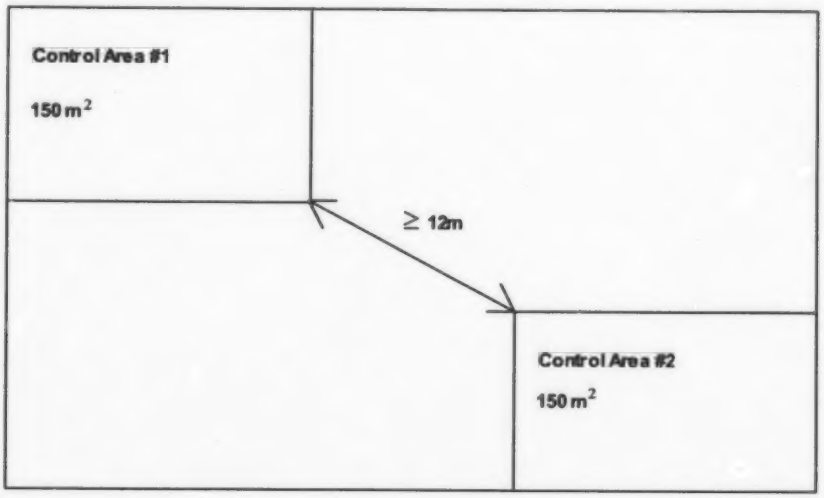
- Arch Chemical has an emergency response number (1-800-654-6911) for assistance 24 hours a day 365 days a year

4.0 MAXIMUM PERMISSIBLE QUANTITY

The **maximum permissible quantity** that can be stored within a single **control area** not exceeding 150 m^2 may be calculated by multiplying the floor area in m^2 times 25 kilograms per square metre. Where the control area exceeds 150 m^2 the maximum quantity shall not exceed 3750 Kg.
A MAXIMUM OF TWO CONTROL AREAS ARE PERMITTED PER BUILDING.

These two control areas shall be separated by:

a) A fire separation having at least a one hour fire-resistance rating, or
b) A minimum horizontal distance of 12 meters between the closest edges of the control areas (please see figure below).



WHERE QUANTITIES EXCEED THESE LIMITS, PART 3 OF THE NATIONAL FIRE CODE 1995 SHALL APPLY.

APPENDIX A

SAMPLE PROBLEMS

PROBLEM #1

How much calcium hypochlorite, pH balancer and algaecide can be stored in a hardware store that is sprinklered and has a retail display area of 250 square metres and a storage area of 200 square metres separated by a wall that has no fire-resistance rating?

SOLUTION #1

A review of the Material Safety Data Sheets for the materials used by this store reveals that calcium hypochlorite is an oxidizing pool chemical, however, the pH balancer and the algaecide are not oxidizing materials. This guide only applies to oxidizing **pool chemicals**; therefore, the calculation of maximum permissible quantity will be limited to calcium hypochlorite and any other similar materials.

Although the retail area measures 250 square metres, for the purpose of the calculation, only 150 square metres may be used. Therefore, the retail portion may contain:

$150\ m^2 \times 25\ kg/m^2 = 3{,}750$ kg of oxidizing **pool chemicals**
(i.e. calcium hypochlorite)

A maximum of two **control areas** are permitted in a building. Thus, a similar calculation can be performed for the storage area of this store. However, a **control area** is defined as a portion of a building that is separated by a fire separation having at least a one-hour fire-resistance rating or by a minimum horizontal distance of 12 meters. In this example, the wall separating the retail and storage portions of the store has no fire-resistance rating. Therefore, a separate control area would be permitted only where the calcium hypochlorite is divided in a manner such that not more than 3,750 kg is kept in each control area and a horizontal distance of at least 12 metres separates the two quantities of pool chemicals.

PROBLEM #2

How much calcium hypochlorite can be kept in a sprinklered building that has a retail area of 144 m^2 (12 m x 12 m) and a storage area of 96 m^2 (12 m x 8 m) separated by a fire separation of 2 hours?

SOLUTION #2

The retail area can contain:

144 m^2 x 25 kg/m^2 = 3,600 kg of calcium hypochlorite

The storage area can contain:

96 m^2 x 25 kg/m^2 = 2,400 kg of calcium hypochlorite

PROBLEM #3

What quantity of **pool chemicals** may be displayed in a store that has a **retail display** area of 1000 m^2, but no **retail storage** area?

SOLUTION #3

As illustrated in A1., a maximum of 3,750 kg of **pool chemicals** can be stored in a **control area**. In this example, if the owner wishes to display more than 3,750 kg of **pool chemicals**, two separate **control areas** would need to be established such that a horizontal distance of at least 12 metres separates the two quantities of **pool chemicals**.

PROBLEM #4

What quantity of **pool chemicals** may be displayed in a **retail store** that is only partially sprinkler protected?

SOLUTION #4

A general requirement for storage of quantities greater than 250 kilograms is that the entire building shall be sprinkler protected. In this example, only part of the store is sprinklered. Therefore, not more than a total of 250 kilograms of **pool chemicals** may be displayed and stored in this building.

An alternate arrangement that may permit storage of greater quantities would be to design in conformance with the NFC.

APPENDIX B

QUESTIONS AND ANSWERS

QUESTION #1

Would it be acceptable to display **pool chemicals** at ground level and provide storage in racks above the display?

ANSWER #1

This is an acceptable arrangement provided that the **maximum permissible quantity** for the control area has not been exceeded, the **pool chemicals** are compatible, suitable sprinkler protection is provided and the other general provisions set out in this guide have been met. In this example, "suitable sprinkler protection" likely means that in-rack sprinklers would be required (please see NFPA 13 - Standard for the Installation of Sprinkler Systems).

QUESTION #2

Where can I obtain information on how to develop an emergency plan?

ANSWER #2

Appendix A to this guide contains a list of items that should be addressed in an emergency plan. Your local fire department may also have guidelines that reflect their ability to respond. You may also wish to review some of the following publications:

Office of the Fire Marshal, "Fire Safety Planning for Industrial Occupancies" July 2000, www.gov.on.ca/OFM/guidetec/2000-02ind.htm

CSA Standard, CAN/CSA-Z731-M95, "Emergency Planning for Industry"

U.S. Department of Labour, OSHA 3088 (Revised) 1995, "How to Prepare for Workplace Emergencies"

Armenante, P.M., 1991, "Contingency Planning for Industrial Emergencies"

American Chemical Council, "Guidelines for Safe Handling and Storage of Calcium Hypochlorite and Chlorinated Isocyanurate Pool Chemicals"

Arch Chemicals, "A Guide for facilities storing pool and spa products preparing an emergency plan"

QUESTION #3

Should anyone review or approve the emergency plan?

ANSWER #3

Once the plan has been completed and approved by senior company officials, the Chief Fire Official should have an opportunity to review and comment on it.

QUESTION #4

Does the Fire Code or some other regulation provide the power to issue orders to require dikes for tanks containing 12% sodium hypochlorite in water?

ANSWER #4

The Fire Code does not have specific requirements for diking of tanks of corrosive chemicals. However, it is appropriate to provide dikes in order to prevent environmental damage when fire exposure from a nearby source may create the potential for a spill into an environmentally sensitive area. Municipal sewer use by-laws may require dikes to be installed.

APPENDIX C

EMERGENCY PLAN

Introduction:

Numerous examples of loss of life and significant property damage that resulted from the absence of an effective emergency plan emphasises the need for preplanning of responses to emergencies.

Fires, spills, gas leaks, explosions and worker injuries are the most common types of situations evaluated for appropriate response.

Audit:

An audit of hazards and existing control measures is an excellent method of determining the existing level of risk. Features such as fire alarm systems, exits, fire department response time and access, portable fire extinguishers, standpipe and hose systems, automatic sprinkler protection, water supplies, emergency power and lighting, voice communication systems, smoke control measures, spill control measures, trained staff and security measures, should be listed in the audit.

Chain of command:

A key element of any emergency plan is the chain of command. A list of persons to be notified in the event of an emergency and responsibilities of various employees and external agencies, will avoid confusion regarding who has the authority to make decisions. The names and phone number of staff (and alternates) trained in emergency procedures should be readily available.

Information:

Relevant information on chemicals (e.g. Material Safety Data Sheets) as required by the Workplace Hazardous Materials Information System (WHMIS), maps, maximum storage quantity, floorplans, utilities (e.g. gas, electricity, water), emergency plans should be readily available to staff and persons responding to an emergency.

Emergency Notification:

Telephone numbers of:
Fire Department
Police Department
Ambulance
MOE, Spills Action Centre, Ontario – 1-800-268-6060
Should also be readily available to staff and persons responding to an emergency.

Emergency Procedures:

Emergency procedures should consider the following topics:

1. Evacuation plans and escape routes including evacuation of persons that require special assistance;
2. Instructions to staff and customers;
3. Notification of emergency services and other agencies;
4. Accounting for staff, visitors and customers in a designated safe area;
5. Responsibilities of staff;
6. Shutoff of electricity and gas;
7. Spill control;
8. Use of personal protective equipment;

Training:

Effectiveness of any emergency plan depends on training to assure that appropriate action is taken. Everyone should receive training to recognize the fire alarm, escape routes, safe handling of oxidising material, fire reporting and clean-up procedures. Certain persons with additional responsibilities will require additional training.

Training should be provided:

- when the plan is first developed;
- when changes occur to materials handled or building layout;
- every 6 months; and
- for new employees.

Equipment:

Having suitable personal protective equipment and spill control agents (e.g. sand) available to control spills can prevent property damage and environmental contamination. Remediation costs can be many times the cost of preventing the spread of hazardous materials.

APPENDIX D

REFERENCES

1. NFPA Fire Investigation Report – "Bulk Retail Store Fire, Albany GA, April 6, 1996"

2. NFPA Fire Investigation Report – "Merchandising Bulk Retail Store Fire, Quincy MA, May 23, 1995"

3. NFPA Technical Report – "National Oxidizing Pool Chemical Storage Fire Test Report, August 1998.

4. NFPA 430 – "Code for the Storage of Liquid and Solid Oxidizers", 2000 Edition

5. NFPA 491, "Guide to Hazardous Chemical Reactions" 1997 Edition.

6. The American Chemical Council, " Guidelines for Safe Handling and Storage of Calcium Hypochlorite and Chlorinated Isocyanurate Pool Chemicals"